Asset Specific Plan

Poles

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1 Purpose

This document forms the ActewAGL Asset Specific Plan for the Poles suite of assets within ActewAGL Distribution. It is intended to define the specific approach to, and principles for, the management of the nominated assets within ActewAGL Distribution.

It provides a justified and evidence based Asset Specific Plan that is used to forecast the volumes and types of intervention and associated costs considered necessary to achieve the defined level of infrastructure, system or asset capability or output, for Poles. As such it provides a whole-life, whole-system based intervention and cost analysis for these assets.

This document and the principles captured within it are derived from and consistent with the overall ActewAGL Asset Management Policy and form a key element of the ActewAGL Distribution Asset Management Plan.

It is a live document which forms the framework for the implementation of Asset Management relating to Poles. It is intended to define the approach to Asset Management taken by ActewAGL Distribution to the management of these assets for both internal and external communication.

2 Good Practice Alignment

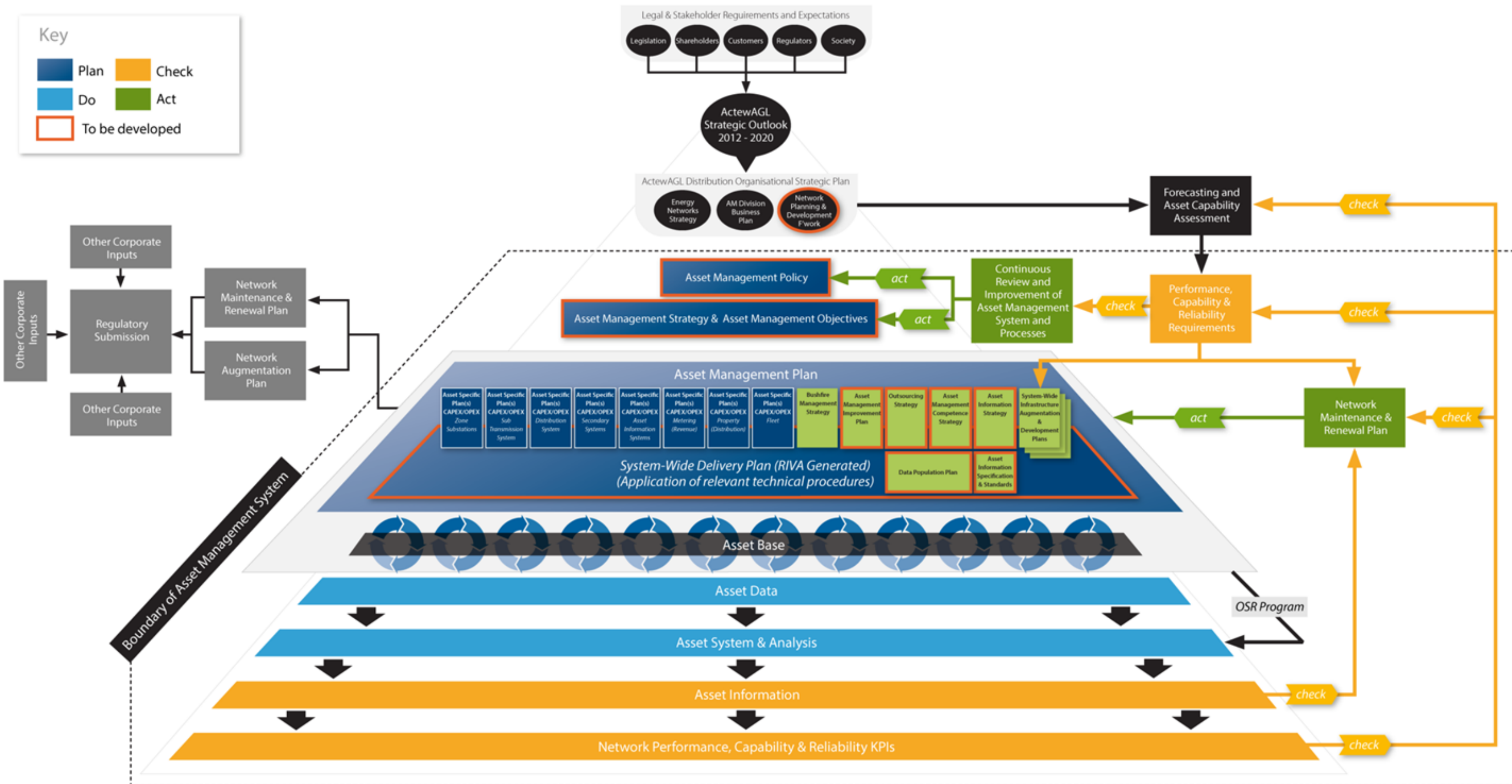
This document has been developed based on good practice guidance from internationally recognised sources, including the Global Forum on Maintenance and Asset Management (GFMAM) and the Institute of Asset Management (IAM). It has been specifically developed to comply with the relevant clauses of BSI PAS 55:2008 and the emerging requirements of ISO55000.

3 Corporate Alignment

This Asset Specific Plan forms a key element of the Asset Management Strategy, as applied to the asset class "Poles". The Asset Management Strategy contains the overarching principles and objectives for the management of this asset class.

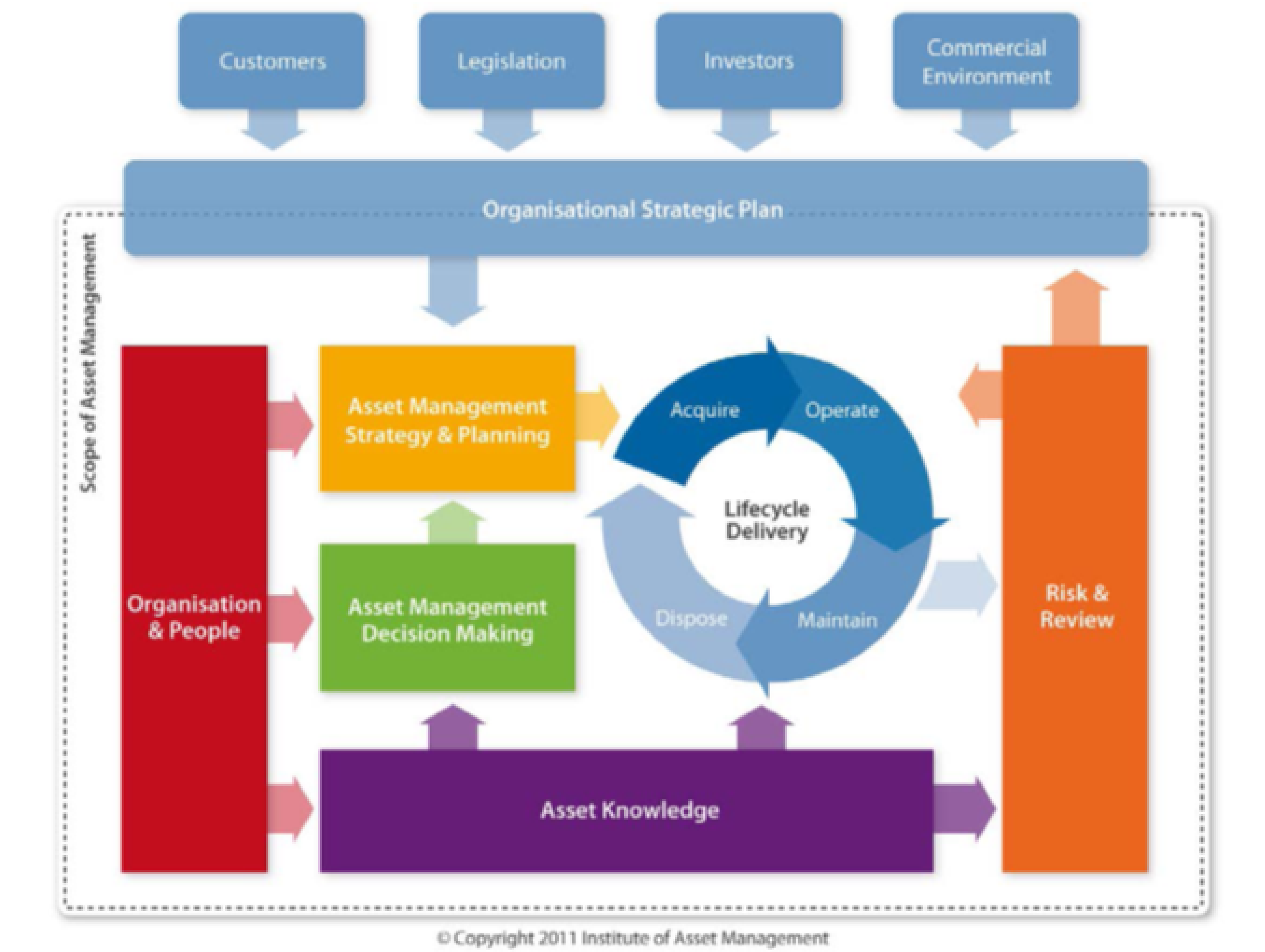
By employing a comprehensive and transparent approach to Asset Management, this Asset Specific Plan provides the evidence for, and justifies the inspection, maintenance and renewal regimes that support the delivery of the required outputs (e.g. safety and asset, system or infrastructure capacity, capability and service reliability, and availability) in conjunction with the Network Augmentation Plan. It also demonstrates that this is planned to be achieved, where appropriate, at minimum whole-life, whole-system cost.

This document's role within the overall Asset Management Framework is shown overleaf.



Key
Plan
Check
Do
Act
To be developed
Legal & Stakeholder Requirements and Expectations
Legislation
Shareholders
Customers
Regulators
Society
ActewAGL Strategic Outlook 2012 - 2020
ActewAGL Distribution Organisational Strategic Plan
Energy Networks Strategy
AM Division Business Plan
Network Planning & Development F'work
Forecasting and Asset Capability Assessment
Other Corporate Inputs
Other Corporate Inputs
Regulatory Submission
Network Maintenance & Renewal Plan
Network Augmentation Plan
Other Corporate Inputs
Asset Management Policy
Asset Management Strategy & Asset Management Objectives
act
act
Continuous Review and Improvement of Asset Management System and Processes
check
Performance, Capability & Reliability Requirements
check
check
Asset Management Plan
System-Wide Delivery Plan (RIVA Generated)
(Application of relevant technical procedures)
Data Population Plan
act
Network Maintenance & Renewal Plan
check
Asset Base
Asset Data
OSR Program
Asset System & Analysis
Asset Information
check
Network Performance, Capability & Reliability KPIs
check
Boundary of Asset Management System

4 Scope - Asset Management Activities



The diagram above represents a conceptual model, intended to describe the overall scope of Asset Management and the high level groups of activity that are included within this discipline. The Model highlights the fact that Asset Management is about the integration of these groups of activity and not just the activities in isolation. It also emphasises the critical issue that Asset Management is there to serve the goals of the organisation. The "line of sight" from an organisation's goals to its Asset Management activities or "alignment" that is promoted in PAS55 is a concept that is carried through to this asset specific plan.

5 Poles Assets

This section contains a subsection for each Poles asset.

5.1 Asset Classification

System/Non-System:	System
Asset Group:	Overhead Distribution
Asset Class:	Poles
Asset Type:	Concrete and Stobie Poles, Fibreglass Poles, Steel Poles, Timber Poles
Asset Rating:	High Voltage and Low Voltage

5.2 Brief Description

The ActewAGL overhead distribution network consists of high voltage, low voltage and service power poles. The pole population is generally categorised by the pole material, voltage level and geographical location (rural or urban).

The basic pole material in use in ActewAGL is natural round timber (wood), Creosote treated (wood), Tanalith treated (wood), concrete, stobie, steel or fibreglass. Natural round timber poles were not originally treated with preservatives and they did not have the sapwood removed. Creosote poles were purchased already pressure treated with creosote preservative. Tanalith poles were purchased already pressure treated with a Copper Chromium Arsenic (CCA) preservative. The oldest natural round poles in ActewAGL's network are made from the most durable Australian hardwood, but were not chemically treated before installation. By the time the Creosote poles were being installed in the early 1970's, many thousands of lower durability natural round poles had been installed, as at that time, the Australian timber industry was no longer able to supply the most durable regal species untreated power poles.

In 2013, 63% of the pole population is wood. Of the 63% wood poles, 38% are reinforced at the base with metal stakes. However, the percentage of wooden pole population is slowly reducing over time as they are gradually replaced by concrete or fibreglass poles. Between 2008 and 2013, the population of wooden poles has declined by 5,500, from 39,000 to 33,480.

ActewAGL's distribution asset databases include 1940 privately owned poles which support overhead lines directly connected to ActewAGL's network. Most of these poles are streetlight poles belonging to the ACT Government. The management and maintenance of ACT Government or corporate private power poles are the owner's responsibility unless there is a pre-arranged agreement with ActewAGL. The management of these private pole and lines is described in EN 4.02 P13 Pole and line inspection procedure and EN 4.09 P62 Management of Private Overhead Electric Lines (POELs). Hence, these ACT Government or corporate private poles will not be further discussed in this plan unless specifically identified.

The 240 private rural poles owned by the individual customers are currently inspected and maintained by ActewAGL at ActewAGL's expense.

5.3 Asset Function

Poles are structures which primarily support ActewAGL's overhead distribution network. Secondary users of these poles include the ACT Government to support some of their streetlight network, Telstra and TransACT to support some of their communications network.

5.4 Asset Interfaces

Power poles interface with the supported asset such as overhead lines, cable terminations, overhead and underground services to customers and pole top hardware such as crossarms.

Power poles also interface with external parties' assets such as the ACT Government streetlights and Telstra and Transact communication assets.

5.5 Data Sources

Data sources include WASP, GIS, and routine inspection records. AMP data is built from extracted Pole asset data from WASP.

5.5.1 Data Quality

Data Completeness: Essential pole data in WASP is 100% complete, however, overall data is about 80% complete.

Where a commissioning date is not directly available, the year for the suburb is used as a default. However, this data is of secondary importance compared to asset condition information updated by regular inspections. Physical verification is also used to validate some of the important conflicting information.

Data Accuracy: Essential pole data in WASP is 100% accurate, however, overall data is about 90% accurate.

Ultimately, the Operational Systems Replacement (OSR) project will provide one source of truth for all asset data. This is expected to be achieved in 2014. In the meantime with multiple data sources, discrepancies creep in, and there are limited processes to find and correct the discrepancies.

Some data fields are very difficult to completely populate, especially for old assets: for example, Date Commissioned.

5.6 Asset Base

ActewAGL pole population consists of several pole types. The table below provides a summary of the asset volumes by the pole material.

Asset Base			
Pole type	**Average Age of Poles**	**Expected Service Life**	**Number of Poles**
Concrete	16	80	10300
Fibreglass	3	70	1930
Steel	14	60	5848
Stobie	65	80	359
Timber	46	45	31243

6 Service and Performance Requirements

6.1 Availability

Overhead power lines are designed to have a high level of service availability. A pole failure will highly likely to result in a feeder or feeder section outage. When distribution overhead power lines trip out, in virtually all cases, customers loose supply.

= (MTBF-RT)/MTBF = (21900 - 7)/21900 = 99.97% Availability.

These input parameters have been sourced from ActewAGL's pole failure history in the past 5 years.

6.2 Reliability

The minimum network distribution reliability requirements are documented in EN 4.4 P07 - Distribution Network Reliability & Standard Supply Arrangement.

The distribution overhead power lines are normally the least reliable components for any Power Utility, and this is no exception for ActewAGL. This level of reliability is largely dictated by the lines being exposed to a wide range of environmental factors. The actual line design is a compromise between cost and aesthetics. It would be possible to build much more robust overhead lines that are less affected by trees, birds, animal, termites, rot, storms, vandalism, etc, but at a much higher cost with poor aesthetics.

Pole are designed, maintained and operated to achieve the minimum network distribution reliability requirements. When distribution overhead power lines trip out, in virtually all cases, customers lose supply. However, as shown in this calculation, poles have not been a major cause of supply reliability problems in recent years.

Reliability = (Population - Failure/Per year)/Population = (49500 - (1/5)/49500) = 99.99%; Note: 1 failure in 5 years.

Pole failures present potential safety risks to both public and employee which is of greater concern than supply reliability.

Pole Performance History

In 2002 there were approximately 800 poles condemned and 10 pole failures. At that time, the pole condemnation rate was considered high, approximately 10 per cent for natural round poles. A serious injury to a lineman occurred when a pole failed in December 2002. At this time, ActewAGL's pole failure rate was at least three times higher than for other electricity network companies with similar poles who belonged to the then ESAA Power Poles committee.

Since then, the pole inspection program has been more rigorous to address the significant increase in pole failures between 2000 and 2004. The pole failure has been reduced to one between the period July 2008 to June 2013.

6.3 Capacity

Most distribution poles currently purchased have either a 5kN or an 8kN equivalent tip load capacity. 5kN poles are normally used in inline or service application. 8kN poles are normally used in termination or angled application. The ultimate tensile strength of the pole is different for each pole type and is normally displayed on the nameplate. The pole strength may deteriorate over time. Regular condition assessment is required to determine the remaining strength, particularly for timber poles.

The standardised pole lengths are typically 9.5m or 12.5 metres pole. 9.5m poles are for low voltage mains and services. 12.5m poles are typically used for high voltage overhead lines. Other pole lengths are also in used to provide greater ground clearance where required. Poles of 11m, 14m, 15.5m, 17m lengths are also in service.

6.4 Asset Utilisation

Poles are designed to have 100% utilisation with respect to the asset function to support required design load.

6.5 Asset Criticality

Poles have a critical function in maintaining the integrity of the overhead network. Pole failures have a direct and immediate impact on the safety, availability, reliability and performance of the power network.

If a pole fails, in addition to the public safety issue, customers will in all cases lose power. The severity of a pole failure on electricity supply depends on the location and voltage level of the affected overhead lines.

Where a pole is situated in rural area, especially in high bushfire risk area, the structural integrity of the pole is critical to bushfire risk.

6.6 Geographical Criticality

The geographic location of a pole also contributes to its criticality in the network.

Poles located in a roadside can be affected by vehicle impacts.

Pole failures in bushfire mitigation areas can potentially cause a fire.

Backyard poles are often difficult to access and present a challenge to pole maintenance.

Pole failure in backyards is an uncontrolled public safety risk.

7 Asset Failure Modes

This section provides tabularised and prioritised details for failure rates by asset type failure mode or best available data.

7.1 Deterioration Drivers

The capability of a pole to provide the service capacity will deteriorate over time due to various environmental factors and third party incidents. The key drivers identified for the deterioration of this capacity for the various pole types are discussed below.

Wood Poles:

· Insufficient structural strength related to loss of pole cross section by rot.

· Insufficient structural strength related to new loads to be applied to the pole.

· Pole top deterioration due to rot and splitting.

· Pole has developed an excessive lean, and if the remaining life of the pole is limited, it may be more economical to install a new pole.

· Pole sapwood is so badly deteriorated, there is either a high risk that a large piece of sapwood would fall on a person, or the pole appears so bad that the public have a strong perception that the pole is unsafe.

· A nailed pole looses so much of its wood below ground level, the nail can move in the resultant void. In this case, the whole pole can sway in strong wind.

· Insufficient structural strength related to loss of pole cross section by termites.

Stobie Poles:

· There has not been a failure of any Stobie pole on ActewAGL's network. It is possible that they have a mean life well in excessive of 100 years. Stobie poles deteriorate mainly by the steel (slowly) rusting.

Concrete Poles

· Insufficient structural strength related to new loads to be applied to the pole.

· Pole is subjected to a shock loading which exceeds the design loading for the pole, and it structurally damages the pole.

Steel Poles:

· Insufficient structural strength related to new loads to be applied to the pole.

· Pole is subjected to a shock loading which exceeds the design loading for the pole, and it structurally damages the pole. (This is yet to occur).

· Insufficient structural strength related to a significant loss of pole cross section by rusting of the steel. (This is yet to occur, however the first of the steel poles to come to the end of their life in this way is likely to happen in the next twenty years. This rusting mainly occurs in a similar area below ground to where wood poles deteriorate with rot. It is possible that a reinforcing technique will be developed to extend the life of steel poles.

Fibreglass Poles

· Manufacture quality issues results in a significant structural weakness.

· Loading shock which exceeds the design loading for the pole, and it structurally damages the pole. (This is yet to occur)

· UV radiation weakening the strength of the pole.

· Moisture ingress weakening the strength of the pole.

7.2 Failure Modes

These are the failure modes associated with each of the asset types.

Concrete and Stobie Poles

FAILURE MODES						
TYPE	**DESCRIPTION**	**OCCURRENCE**	**SEVERITY**	**DETECTION**	**RPN**	**UNIT COST**
New loads to existing poles	Insufficient structural strength related to new loads to be applied to the pole. Pole fails as a result which poses a risk to public safety, employee safety, loss of supply and public media coverage. Probability of occurrence is once in 200 years.	No Known Occurrences	Minor	Certain	3	
Vehicle or Third party impact	Pole is subjected to a shock loading which exceeds the design loading for the pole, and it structually damages the pole.	No Known Occurrences	Minor	Certain	3	

Fibreglass Poles

FAILURE MODES						
TYPE	**DESCRIPTION**	**OCCURRENCE**	**SEVERITY**	**DETECTION**	**RPN**	**UNIT COST**
Incorrect installation	Fibreglass pole which has not been properly insstalled lead to premature failure. For example, insufficient overlapping of the two pole module which causes a reduction in tensile strength and an increase in the bending moment on the pole. The worst case scenario is a pole failure which will pose a risk to public safety, employee safety, loss of supply to few customers, and loss of company reputation. No known pole failure has occurred for this failure mode.	No Known Occurrences	Minor	Certain	3	
Moisture ingress	Moisture ingress weakens the fibre structure affecting the structural integrity. Pole falls down over time. This failure mode poses risk to public and employee safety, loss of reputation and media coverage. The probability of occurrence is once in 1000 years. Manufacturer has performed an accelerated ageing test to prove that the fibreglass pole retains 80% of its strength after 60 years of exposure of UV radiation and moisture.	No Known Occurrences	Very Minor	Certain	2	

UV radiation	UV Radiation weakens the fibre structure affecting the structural integrity. Pole falls down over time. This failure mode poses risk to public and employee safety, loss of reputation and media coverage. The probability occurs once in 60 years. Manufacturer has performed an accelerated ageing test to prove that the fibreglass pole retains 80% of its strength after 60 years of exposure of UV radiation and moisture.	No Known Occurrences	Very Minor	Certain	2	
Variable manufacture quality	Varying manufacturing quality affects the structure strength. Pole falls down in service as a result. This failure mode poses risk to public and employee safety, loss of reputation and media coverage. The probability occurs once in 50 years.	No Known Occurrences	Very Minor	Certain	2	

Steel Poles

FAILURE MODES						
TYPE	**DESCRIPTION**	**OCCURRENCE**	**SEVERITY**	**DETECTION**	**RPN**	**UNIT COST**
Corrosion of steel material	Insufficient structural strength related to a significant loss of pole cross section by rusting of the steel. As a result, pole falls down. This failure mode poses risk to public and employee safety, loss of reputation and media coverage. The probability occurs once in 20 years. The current control in place for pole inspection and maintenance reduces the probability of occurrence.	No Known Occurrences	Moderate	Certain	5	
Insufficient burial depth or soil pressure	Insufficient burial depth/Insufficient soil pressure causing pole to lean. As a result, pole falls down. This failure mode poses risk to public and employee safety, loss of reputation and media coverage. The probability occurs once in 20 years. The current control in place for pole inspection and maintenance reduces the probability of occurrence.	No Known Occurrences	Moderate	Certain	5	
New loads to existing poles	Insufficient structural strength related to new loads to be applied to the pole. Pole fails as a result which poses a risk to public safety, employee safety, loss of supply and public media coverage. Probability of occurrence is once in 200 years.	No Known Occurrences	Minor	Certain	3	

FAILURE MODES

TYPE	DESCRIPTION	OCCURRENCE	SEVERITY	DETECTION	RPN	UNIT COST
Reinforced pole loses below ground good wood	A nailed pole loses so much of its wood below ground level, the Nail can move in the resultant void. As a result, conductor clashes or touches buildings. This failure mode poses risk to public and employee safety, loss of reputation and media coverage. The probability occurs once in 5 years. The current control in place for pole inspection and maintenance reduces the probability of occurrence.	Relatively Few Failures	Minor	Likely	22.5	
Pole top deterioration due to rot and splitting	Pole top falls down. This failure mode poses risk to public and employee safety, loss of reputation and media coverage. The probability occurs once in 5 years. The current control in place for pole inspection and maintenance reduces the probability of occurrence.	Relatively Few Failures	Minor	Almost Certain	15	
Insect Damage	Insufficient structural strength related to loss of pole cross section by termites. Pole falls down as a result. The pole down poses a risk to public and employee safety, loss of electricity supply, loss of reputation and media coverage. This failure mode is expected to occur once in 20 years. However, with the current control in place, the probability of failure is reduced.	Relatively Few Failures	Moderate	Certain	12.5	
Pole Rot	Insufficient structural strength related to loss of pole cross section by rot. Pole falls down as a result. The pole down poses a risk to public and employee safety, loss of electricity supply, loss of reputation and media coverage. This failure mode is expected to occur once in 10 years. However, with the current control in place, the probability of failure is reduced.	Relatively Few Failures	Moderate	Certain	12.5	
Vehicle or Third party impact	Pole is subjected to a shock loading which exceeds the design loading for the pole, and it structually damages the pole.	Relatively Few Failures	Moderate	Certain	12.5	
New loads to existing poles	Insufficient structural strength related to new loads to be applied to the pole. Pole fails as a result which poses a risk to public safety, employee safety, loss of supply and public media coverage. Probability of occurrence is once in 100 years.	No Known Occurrences	Minor	Likely	9	
Pole developed						

an excessive lean	Insufficient soil pressure due to change in pole vertical position	Relatively Few Failures	Minor	Certain	7.5	
Pole sapwood is poorly deteriorated	A large piece of sapwood would fall on a person. This failure mode poses risk to public and employee safety, loss of reputation and media coverage. The probability occurs once in 20 years. The current control in place for pole inspection and maintenance reduces the probability of occurrence.	No Known Occurrences	Moderate	Certain	5	

7.3 Consequences

The consequence of a pole failure will pose a risk to public safety, risk to employees, potential start of bushfire, and the loss of supply.

The definition of a pole failure suggests both assisted and unassisted failure for the purpose of this document. This definition is different from the definition defined in in EN 4.02 P13 - Pole and Line Inspection Procedure.

8 Maintenance and Replacement Strategies

On-going condition monitoring, maintenance and augmentation of the distribution network pole population is a key strategy in supporting the safety, reliability and performance of ActewAGL distribution network. The strategies established by ActewAGL to manage the distribution pole assets are described in this section.

8.1 Description of Strategies

Maintenance and Pole Management

The current pole management strategy is to:

- Achieve and maintain zero pole failures.
- Ensure pole integrity between inspection cycles.
- Achieve maximum pole life.

In summary, the pole management involves the following activities:

- Pole and line inspection.
- Pole replacement and reinforcement.
- Pole and line defect repair.
- Pole inspection, construction and maintenance quality audit.
- Redundant pole removal.

Pole and Line Inspection (Condition Monitoring)

The structural integrity of poles deteriorates over time. Routine inspections of the pole condition can identify defects which can cause pole failure and allows these defects to be addressed.

Poles located in the Bushfire Prone Areas are fully inspected every three years and visually inspected every year in accordance with EN 4.09 P01 ActewAGL Bushfire Mitigation Strategy & Management Plan.

All other poles are inspected every 4.5 years in accordance with EN 4.02 P13 - Pole and Line Inspection Procedure.

All poles and overhead asset inspection are completed in accordance with FSW 203 Pole and Line Inspection Manual.

Most wooden poles are condemned because of a loss of strength in the buried section of the pole near ground level. This loss of strength is typically the result of rot, termites or bushfire. Natural round wood poles have no preservative treatment carried out prior to being installed in the ground which increases the risk of rot and/or termites. As a result, the condemnation rate for natural round poles is approximately 10 times greater than the other types of wood poles (Creosote and Tanalith (CCA)).

In addition to the main reasons for condemning a pole, it is estimated that at least half of the natural round wood poles have cross-arms attached with a non-galvanised (black) king bolt. These bolts are 40+ years old and are corroding. The resultant rust is causing the pole heads to split which leads to moisture ingress and rot spore invasion. Many of these poles will require replacement because of severe loss of strength in the pole head.

Over the last four years, on average 60% of these poles that were condemned have been reinforced and remain in the network. This ratio is forecast to remain the same in the next regulatory period.

Pole replacement and reinforcement (Unplanned Maintenance)

Two methods historically used by ActewAGL to address condemned poles are replacement and reinforcement. This is aligned with the practices of other Australian network service providers.

Poles typically deteriorate at the interface area between above ground and below ground. While the above ground portion of the pole deteriorates over time, the rate is slower than the below ground portion. As a result, many condemned poles are suitable for reinforcement and continued service in the network. Reinforcing poles allows for the deferral of capital expenditure by extending the life of the pole.

Pole reinforcement involves the installation of a galvanised steel (nail) adjacent to a power pole. The nail is driven into the ground and attached to the pole using galvanised bolts. Replacement of a reinforced pole is typically determined by the above ground condition of the pole.

The pole replacement program involves the complete removal and replacement of the condemned pole with a new concrete (Urban street or Rural areas) or two piece fibreglass (Urban backyards) poles. Condemned timber poles located on the urban street of the heritage precincts areas are typically replaced with tanalith poles as required by the ACT Heritage Council.

The balance between replacement and reinforcement needs to be carefully controlled as the overuse of reinforcement may lead to a step increase in expenditure and an inability to resource the replacement program in future regulatory periods. Around 800 poles are forecast to be replaced every year and 700 are forecast to be reinforced every year between FY14/15 to 19/20. This is based on the decreasing timber pole population, having an average condemnation rate of 4%.

In addition, the pole inspection in 2013 condemned a number of poles which were in difficult to access locations. These poles have been reinforced to allow time to construct a suitable access track to prepare for a pole replacement. It is planned and budgeted to complete 33 poles of these every year in FY14/15 and 15/16.

Pole and Line defect repair (Unplanned Maintenance)

As a part of our pole and line inspection, overhead assets with deteriorating condition and defects are also identified in accordance to FSW 203 - Pole and Line Inspection Manual.

These defects are prioritised based on the risk to the public safety, employee safety, network reliability and asset integrity.

Priority 1 defects require immediate response (reactively).

Priority 2 defects require maintenance in a planned manner. For example, pole leaning more than three pole heads, missing earth conductor, damaged earth and all defects that presents an unacceptable hazard to public safety and our employees.

Priority 3 defects should be addressed if resources allow, otherwise there is an acceptably low risk to leave for next inspection. For example, missing asset number, concrete poles spiral cracking and all defects that have acceptably low risk to ActewAGL assets, employees and public if left for another inspection cycle. Based on the historical work in the past five years, 242 priority repair work has been budgeted for every year.

Pole maintenance quality audit (Planned Maintenance)

Pole maintenance activities are audited by an independent auditor every month. The process, frequency and auditing criteria for pole inspector and pole inspection are documented in EN 4.09 P31.

10% of the pole construction, replacement or repair activities are audited. The auditor provides pole inspectors and lineworkers with feedback for continuous skill improvement. $250k has been allowed every year for the quality audit.

Redundant pole removal (Planned Maintenance)

Approximately 30 redundant poles are removed from residential suburb every year. These poles become redundant when surrounding blocks in a section no longer require the overhead electricity supply, for example, if the area becomes underground reticulated.

The volume of work required for other budgeted maintenance activities (generally based on historical experience) are summarised below:

- 485 LV neutral bonding to conductive pole in FY14/15. As a part of the safety initiative to address electric shock from low voltage conductive poles (Steel, concrete and Stobie), approximately 1001 LV conductive poles were identified to require neutral bonding. A planned program was initiated in FY12/13 with the planned completion of this work by FY14/15. 516 are planned to be completed by FY13/14 and the remaining 485 will be completed in FY14/15. (Planned Maintenance)
- 7 x straighten unacceptable pole lean identified from pole inspection based on historical work. (Unplanned Maintenance)
- 1 x rural private pole maintenance every year from pole inspection based on historical work. (Unplanned Maintenance)

8.2 Minimum Whole-of-Life Whole-of-System Cost

Requirement for providing electricity to ACT customers

The overhead network provides the most cost effective means of reticulating electricity supply to our customer. Although all new green field sites are reticulated underground since 1980s, the existing overhead network is unlikely to be undergrounded due to the high capital cost in comparison to maintaining or replacing an overhead network. The overhead network will remain for the foreseeable future.

Requirements for power pole

The existence of an overhead network drives the requirement for poles which support the overhead lines and pole top hardware such as insulators and crossarms. Poles are specified to carry the full design load with a safety factor of at least two. Pole suppliers/manufacturers are selected from a tender process and procured under a period contract.

Construction/Installation of Poles

Because all new green field site are reticulated underground, there are limited number of poles in new constructions. Most of the pole construction comes from relocation of existing overhead poles for customer initiated projects or pole replacement in the existing overhead network.

Maintenance/Replacement

The maintenance strategy of poles is discussed in Section 8.1 Description of Strategies. It is important to understand that these strategies were developed to prevent catastrophic pole failures which pose major risks to public safety, employee safety and the risk of starting a bushfire. The pole inspection frequency, pole reinforcement and replacement program reduce the overall risk of the fleet of pole assets.

Disposal

The disposal of poles is discussed in Section 8.6 Disposal Plan.

The software product, Riva DS, was used to evaluate the minimum, whole-life, whole-system cost approach to determine the optimal intervention options and scenarios.

8.3 Alternative Scenarios

A detailed analysis of alternative scenarios will be carried out after the Riva DS software is implemented at ActewAGL. Optimisation has been done on the basis of balancing intervention (maintenance) costs with asset risk over the lifetime of the asset. This is done by calculating the value of risk that accrues to a given asset, and which escalates year on year as that asset ages and deteriorates. At some point in time, the annual cost of risk is high enough to warrant the capital expenditure to replace the asset, and hence reduce the risk cost back to that of a new asset. RIVA will optimise the Life Cycle Asset cost with respect to the life span versus risk cost trade off. The types of interventions which have been considered include replacement, refurbishment and inspections. Riva has chosen the optimum combination of these interventions. Where insufficient failure information was available at this time, recommended lifespan was used as a proxy.

8.4 Asset Costs

Unit costs for work on this asset class have been estimated by Program Development Branch. Details of the estimate are available in \\jeeves\energynetwk\Program of Work\future pow\AMP Reg Submission.

8.4.1 Planned Maintenance

UNIT COSTS			
ASSET TYPE	TASK	COST BASIS	UNIT COST

Poles	Audit Pole Inspection, Inspector and Construction	(Planned List) The cost associated with auditing our pole inspectors, their inspections and lineworker quality of work. $250,000 has been allocated to audit 10% of the maintenance activities on poles and overhead line every month.	$250,000
Poles	Bond LV Conductive pole without neutral bonding	(Planned List) As a part of the safety initiative to address electric shocks from low voltage conductive poles (Steel, concrete and Stobie), approximately 1001 LV conductive pole were identified to be neutral bonded. A planned program was initiated in FY12/13 with the planned completion of this work by FY14/15. 516 are planned to be completed by FY13/14 and the remaining 485 will be completed in FY14/15.	$912
Poles	Remove pole due to redundant overhead network	(Planned List identified from pole inspections) Approximately 19 redundant poles are planned to be removed, especially in area such as Braddon and Turner. Each pole removal cost takes half a day for a three man crew to travel, prepare, remove and recycle overhead pole & equipment = $4100 (4 hours for one crew)	$4,100
Poles	Replace Pole with Access Difficulty	(Planned List) Approximately 33 poles with difficult access are planned for replacement FY14/15 to FY15/16. These poles have been identified from the rural pole inspection where there are no existing access tracks for the pole replacement. In order to replace these poles, civil works for new access tracks or helicopter support are required for the replacements to proceed.	$36,925

8.4.2 Unplanned Maintenance

UNIT COSTS

ASSET TYPE	TASK	COST BASIS	UNIT COST
Poles	Maintain or Replace Rural private pole	(Unplanned work identified from pole inspection) Allowance to maintain rural private pole every year under urgent basis - one private pole replacement per year based on historical cost.	$11,925
Poles	Maintain pole due to priority repair works	(Unplanned work identified from pole inspection) Priority repair work due to unacceptable hazards to public safety, employee safety or asset integrity for an estimated 242 poles per year such as ground subsidence, rabbit holes, ivy over poles...etc.	$3,078
Poles	Reinforce poles	(Unplanned work identified from pole inspection) Estimate 700 wood poles is suitable for reinforcement for the balance of condemned pole that are not replaced. Cost estimate $1,095 per reinforcement.	$1,095
Poles	Straighten leaning pole	(Unplanned work identified from pole inspection) Allowance to address unacceptable pole lean. 7 have been budgeted for every year, based on the average of number of straighten pole work tasks between FY08/09 to FY11/12.	$7,934

8.4.3 Condition Monitoring

UNIT COSTS

ASSET TYPE	TASK	COST BASIS	UNIT COST
Poles	Inspect pole	(Planned List) 4.5 yearly cycle of pole inspection for urban poles. 3 yearly cycle of pole inspection for rural pole. A standard inspection cost $232.	$232

8.4.4 Asset Unit Costs

UNIT COSTS		
ASSET TYPE	TASK	UNIT COST
Concrete and Stobie Pole	Replacement Cost	$12,660

8.5 Rationalisation Opportunities

The overhead network is slowly contracting by a rate of about 0.4% per annum based on the reduction of the pole population. The main reason for reduction in pole population is because of all new green field sites are underground reticulated and land development occasionally underground existing overhead network.

Where the pole becomes redundant, they will be physically removed from the ground.

Since the mid 1980's, all new green field sites are underground reticulated. Underground reticulation originally came about in the Australian Capital Territory when developers were willing to pay a higher capital contribution to reticulate new subdivision with an underground network instead of overhead. This reflected the wishes of the block purchasers who were prepared to pay more for their block and house so that they would have better amenity through not having overhead power lines. A policy was developed as a result where all new green field sites were underground reticulated. This arrangement suited ACTEA/ ACTEW (predecessors of ActewAGL) as the ongoing maintenance costs are lower, and the reliability is higher.

8.5.1 Other Options

Alternative to overhead network is underground network. There have been several studies to determine the cost of undergrounding ActewAGL's existing urban overhead network. The findings from each of these studies showed that it is generally not economical.

There are two locations (Gudgenby and Corin) where ActewAGL intends to remove a total 16km of HV overhead line, and supply the customers with ActewAGL owned and operated Remote Area Power Systems (RAPS). Justification for this change is based on reducing the bushfire risk, and to reduce OPEX costs to maintain power lines through rugged bushland to supply a few remote customers. The above comment relates to extreme cases of geographical criticality. Being a regulated business ActewAGL Distribution is required to continue to supply these customers. The justification and installation cost of the RAPS has been discussed and budgeted in the "Bushfire Mitigation - Remote Area Power Supply - Network Augmentation Plan".

There have been several changes to standard designs to improve the performance of the overhead network, and some examples follow:

- New poles are made of materials that do not rot and are not affected by termites. Currently we buy concrete poles where we have good access, and fibreglass 2 piece poles where we have poor access.
- New cross-arms are made of materials that do not rot and are not affected by termites. Currently we buy fibreglass crossarms.
- All new and extended buildings are serviced via a new underground cable.
- All new overhead service cables are insulated with XLPE plastic which is expected to have twice the service life of the earlier PVC insulation. Bare overhead conductor will normally outlast all the other line components. Sections of this conductor will occasionally be removed and replaced with Aerial Bundled conductor or an underground cable due to clearance issue.

8.5.2 Feasibility and Business Case

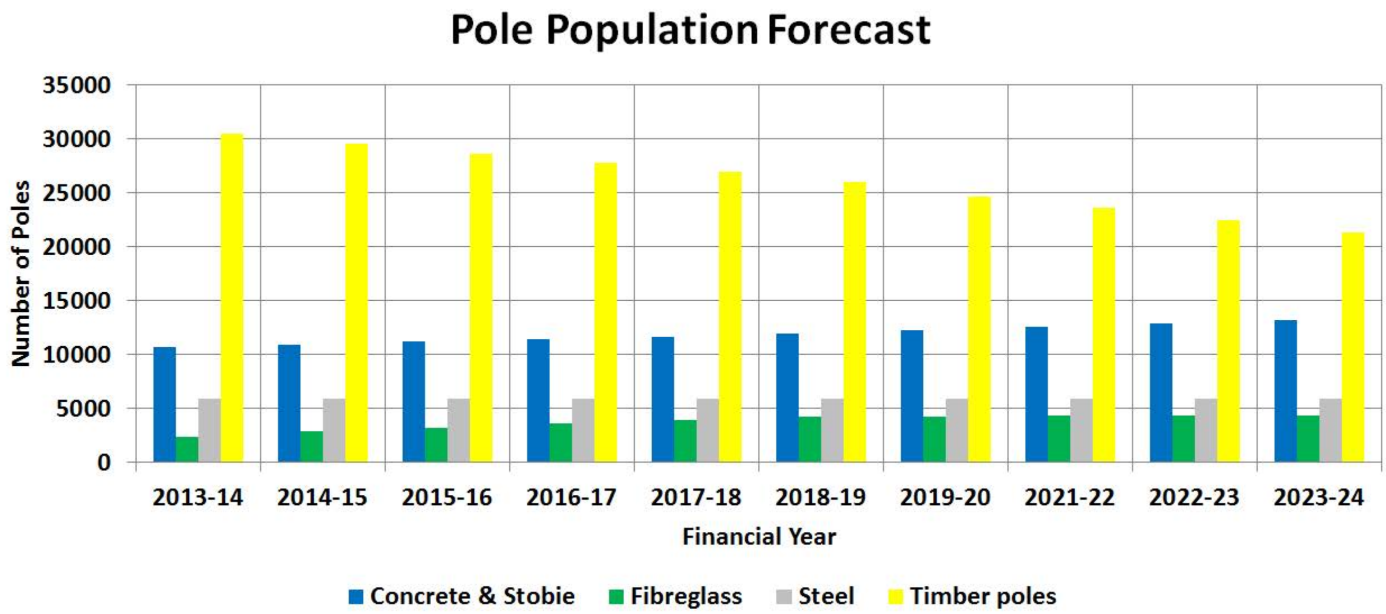
The business case for replacing overhead with underground includes cost of removal of the overhead lines, installation of underground cables as capital costs with an offset by operational savings in line with maintenance and vegetation clearing from the powerline corridor. In general, on purely financial considerations, it is not economical to replace overhead with underground powerlines, however where customers or other stakeholders are prepared to make a capital contribution, a business case may be developed to justify the undergrounding project.

8.6 Disposal Plan

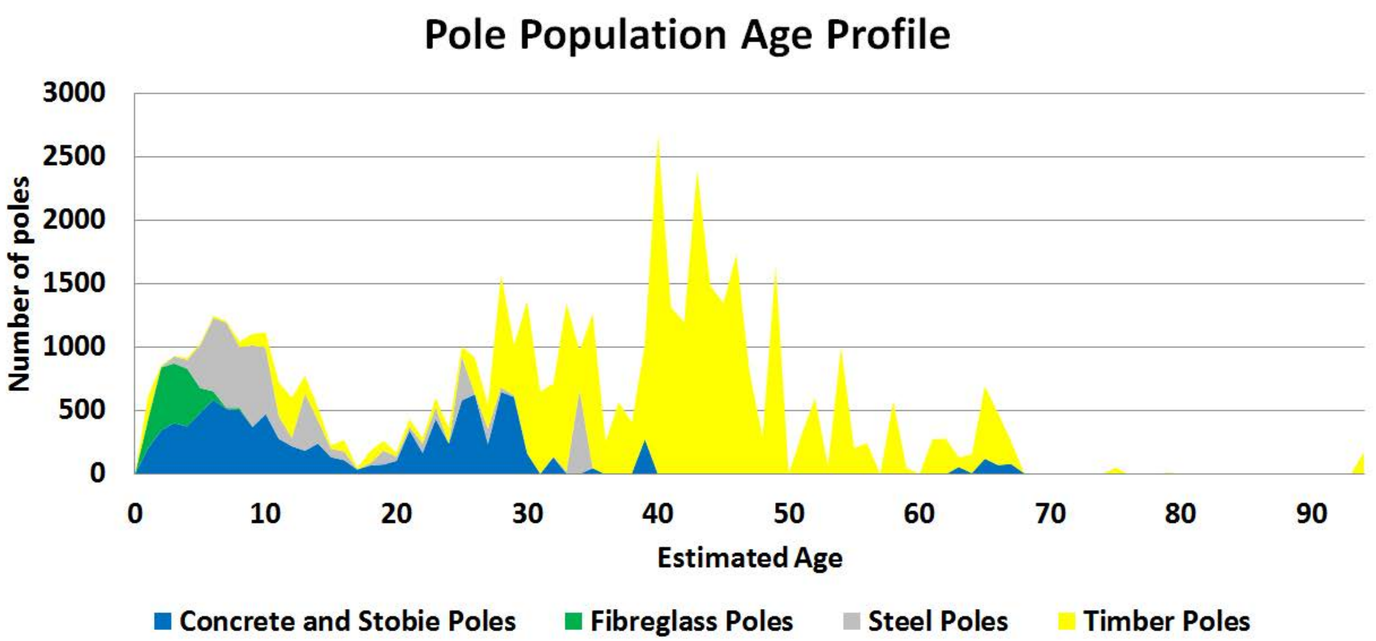
All redundant assets are either recovered for re-use or disposed to eliminate any hazard on site which may pose a risk to the community. Redundant poles are inspected and assessed to determine whether it can be re-used and recovered back to store. Redundant treated timber poles which cannot be re-used, are disposed responsibly in accordance with the ACT environmental standards for waste disposal. The disposal plan for all assets are documented in the policy document, "Recovery and disposal of reclaimed network assets". Information for the control of waste materials at Greenway Services Centre is available in Electricity Networks procedure EN 4.9 P5 Waste Disposal.

9. Asset Condition and Expenditure Forecast

9.1 Projected Asset Count



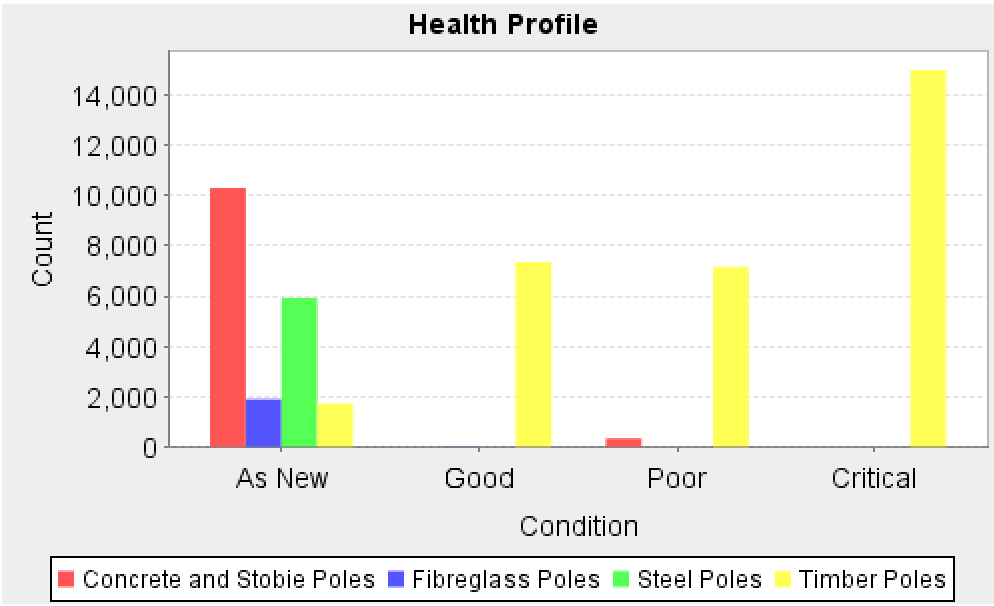
9.2 Age Profile of Assets



Note: Poles with unknown estimated age is not plotted on this chart

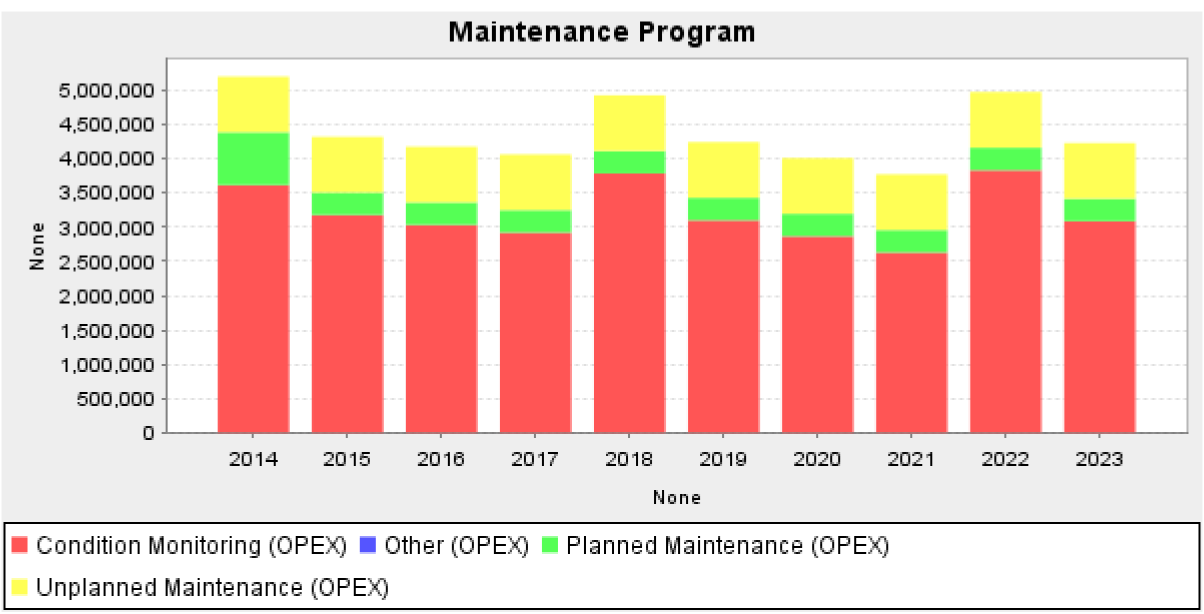
9.3 Health Profile

Health profile is determined by combining the asset condition rating with its criticality rating. Condition is determined by the asset's capacity to meet requirements, the asset reliability and its level of obsolescence. Obsolescence will be determined by maintenance requirements and availability of support from manufacturers. Criticality is determined from operational, safety and environmental consequences due to asset failure.



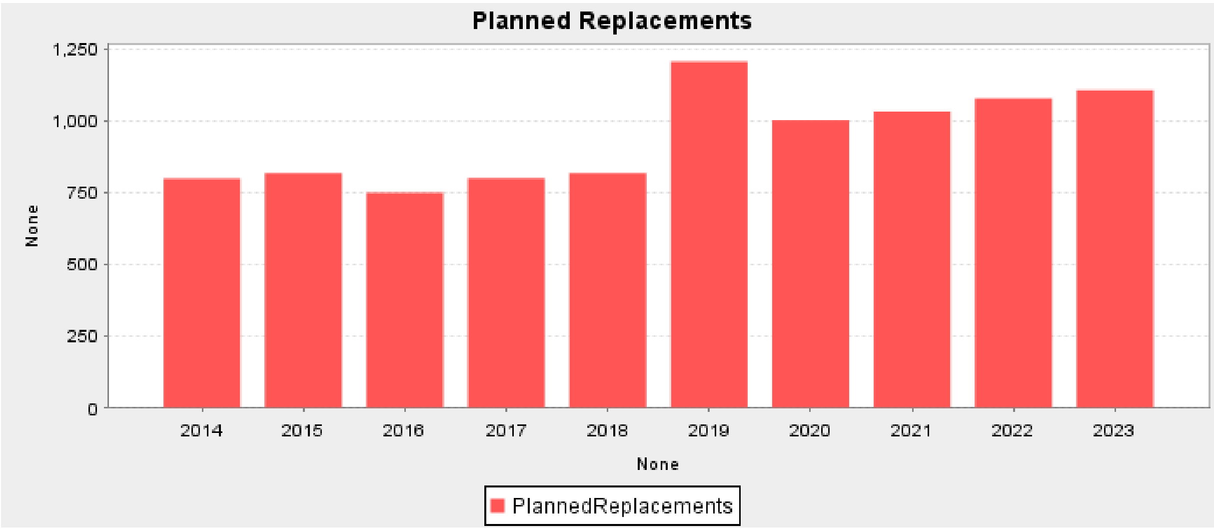
*Health Score: As New(100-95), Good(95-75), Poor(75-50), Critical(50-0)

9.4 Maintenance Program



9.5 Replacement Program

This is a summary of the units being replaced or refurbished each year. In general, assets with the lowest health will be scheduled for earliest replacements.

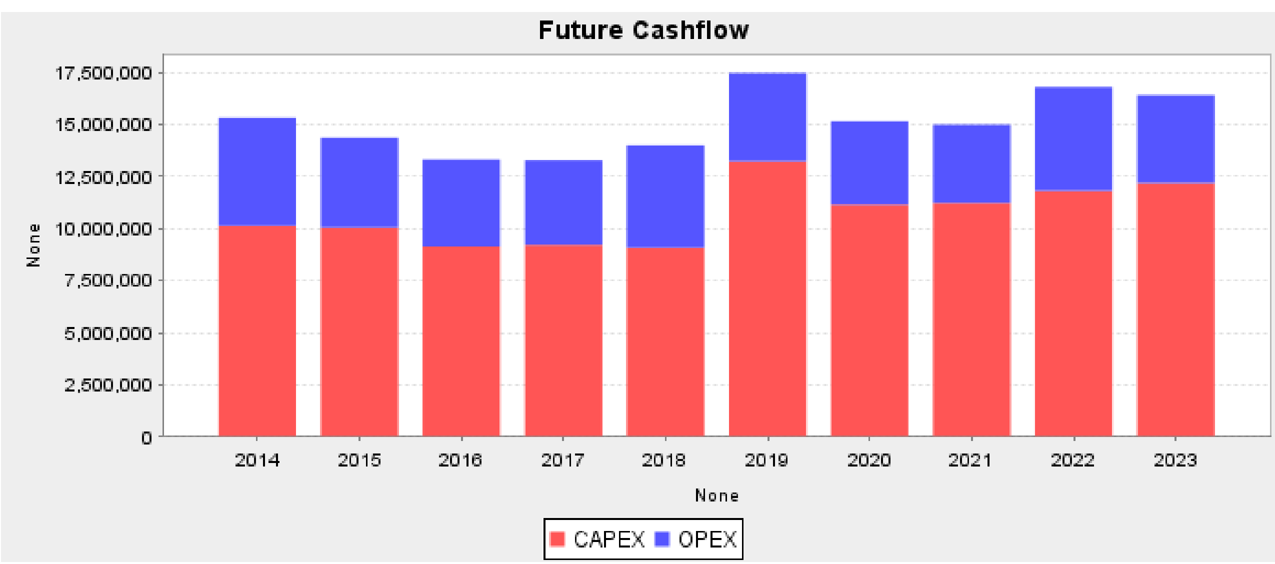


9.6 Forward Cashflow

This cashflow is based on the replacement and refurbishment program and is shown in 2012 dollars.

The table below summarises the OPEX and CAPEX forecasts for the next 10 years.

Expenditure	10 Year Total	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24
Replacement total (CAPEX)	$107,269,596	$10,134,579	$10,050,843	$9,146,706	$9,220,182	$9,081,258	$13,235,991	$11,151,285	$11,236,011	$11,824,386	$12,188,355
Maintenance total (OPEX)	$43,882,014	$5,195,822	$4,317,097	$4,172,904	$4,060,346	$4,923,067	$4,239,877	$4,006,783	$3,769,855	$4,970,083	$4,226,180
Condition monitoring (OPEX)	$32,037,304	$3,613,263	$3,176,858	$3,032,665	$2,920,107	$3,782,828	$3,099,638	$2,866,544	$2,629,616	$3,829,844	$3,085,941
Planned maintenance (OPEX)	$3,721,320	$770,220	$327,900	$327,900	$327,900	$327,900	$327,900	$327,900	$327,900	$327,900	$327,900
Unplanned maintenance (OPEX)	$8,123,390	$812,339	$812,339	$812,339	$812,339	$812,339	$812,339	$812,339	$812,339	$812,339	$812,339



10 Performance Monitoring

The performance of the pole asset and its planned activities is monitored by weekly and monthly reports. These report provides a form of feedback on the planned maintenance activities.

The following information are obtained:

· Poles condemned in each suburb.

· Non-wooden poles condemned.

· Rural/urban poles condemned.

· High voltage/Low voltage poles condemned.

· Condemned verses non-condemned poles replacement

· Reinforced verses non-reinforced poles replacement

· Non-wooden poles replaced.

· Rural/urban poles replaced.

· High voltage/Low voltage poles replaced.